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GROUP LEARNING PROCESSES AND PROPERTIES OF TACIT AND EXPLICIT KNOWLEDGE

SEUNGHO CHOI

Asssitant Professor, Department of Management, Ewha School of Business, Ewha Womans University, Seoul, South Korea

ABSTRACT

This paper examines how the properties of tacit and explicit knowledge can affect group learning processes of knowledge workers. Two types of knowledge (tacit and explicit knowledge) have different characteristics based on the four dimensions (codifiability, complexity, context specificity and consciousness). I explain how these properties of knowledge induce disparate group learning processes (sharing, storage, and retrieval). This consideration reveals the dilemma of knowledge workers facing in their group learning: Whereas tacit knowledge held by knowledge workers may lie at the heart of their group learning, the properties of tacit knowledge impedes sharing, storing and retrieving it among knowledge workers. I propose transactive memory as an intervention that eases the dilemma of knowledge workers in group learning.

KEYWORDS: Group Learning, Tacit and Explicit Knowledge, Transactive Memory

INTORODUCTION

Organizations heavily rely on teams (work groups) to implement their important strategic and operational tasks (Edmonson, Dillon, and Roloff, 2007). Participants for the work groups face diverse tasks and contexts and they provide the participants for learning opportunities. Previous group learning literature has mainly focused on the outcomes of group learning such as group creativity and problem solving capacity, and group decision making. The heavy emphasis on the outcomes of group learning creates a lack of studies, which pay attention to the basic learning processes (Wilson, Goodman, and Cronin, 2007). The purpose of this paper is to extend the understanding of group learning by bringing knowledge properties into group learning processes. I delineate two types of knowledge (tacit and explicit knowledge) and elaborate their differences based on the four dimensions (codifiability, complexity, context specificity and consciousness) from strategic management research (Kogut and Zander, 1992; Nonaka, 1994; Polayni, 1966). I then introduce three basic processes of group leaning (sharing, storing, and retrieving) and examine interactions between knowledge properties and each process by introducing a mediator in each process. This examination reveals the dilemma of tacit knowledge that knowledge workers face in their group learning. Whereas tacit knowledge held by knowledge workers may lie at the heart of their group learning, the properties of tacit knowledge impedes sharing, storing and retrieving it among knowledge workers. I draw on a possible intervention to ease this dilemma: transactive memory (Wegner, 1987). Finally, I conclude by discussing the implications for research and practice and suggestions for future research.

THEORY AND PROPOSITIONS

Knowledge Types and Group Learning

Organizations heavily rely on teams (work groups) to implement their important strategic and operational tasks (Edmonson, Dillon, and Roloff, 2007). Participants for the work groups face diverse tasks and contexts and they provide the participants for learning opportunities. Group learning refers to “the acquisition and application of knowledge that

enables a team to address team tasks and issues for which solutions were not previously obvious. (Sole and Edmonson, 2002; 18)" Knowledge can be considered as one of the raw materials for group learning. For instance, most definitions of group learning implicitly and explicitly show that knowledge is the key components for group learning (e.g. Argote et al, 2001; Sole & Edmonson, 2002; London, Polzer and Omoregie, 2005) as described in Table 1. This implies that the characteristics and properties of knowledge can influence group learning processes. Nevertheless, there has been lack of research to comprehensively link the properties of knowledge with group learning processes with some exceptions (Wilson et al, 2006; Argote and Ingram, 2000). Traditionally, macro management researchers (e.g., strategy and organization theory) extensively examined the role of knowledge in organizations. In particular, strategic management research considered knowledge as the one of key resources to create and sustain competitive advantages and considered firms as a bundle of knowledge (see, Grant, 1996; Spencer, 1996) and they deeply examined the characteristics and nature of knowledge. In contrast, group learning has received mainly attention from micro management researchers (e.g, organizational behavior, social psychology, and human resource management). Due to the separation of different research communities, there is a lack of attempts to integrate the complementary perspectives between knowledge properties and group learning. Based on this research gap, this paper contributes to the understanding of group learning process by considering knowledge properties in knowledge management literature.

Table 1: Knowledge and Group Learning Definitions

Argote, Gruenfeld, & Naquin (2001: 370)	The activities through which individuals acquire, share, and combine knowledge through experience with one another
Ellis, Hollenbeck, Ilgen, Porter, & West (2003: 822)	A relatively permanent change in the team's collective level of knowledge and skill produced by the shared experience of team members
Gruenfeld, Martorana, & Fan (2003: 46–47)	The acquisition, persistence, diffusion, and depreciation of group knowledge
London, Polzer, &Omoregie (2005: 114)	The extent to which members seek opportunities to develop new skills and knowledge, welcome challenging assignments, are willing to take risks on new ideas, and work on tasks that require considerable skill and knowledge

Explicit and Tacit Knowledge

Knowledge is a multifaceted concept with multilayered meanings (Nonaka, 1994). Polanyi (1966) classified human knowledge into two categories: explicit and tacit knowledge. "Explicit" knowledge refers to knowledge that can be transmitted in formal, systematic language. On the other hand, tacit knowledge is hard to formalize and communicate. Polanyi (1966:4) described tacit knowledge by saying "We can know more than we can tell." Based on the strategic management literature, this paper described the main differences between two types of knowledge based on four dimensions: codifiability, complexity, context specificity, and consciousness in the following sections. The main characteristics of two types of knowledge are summarized in Table 2. It is important to note that I do not suggest that two types of knowledge are mutually exclusive or that knowledge is wholly tacit or explicit. Even though these two forms of knowledge are widely regarded as being distinct, they are not clearly distinctive (Gourlay, 2004). All knowledge contains some degrees of tacit and explicit dimensions. The point is that knowledge can be categorized in terms of the relative dominant type of tacit and explicit dimension.

Table 2: The Properties of Tacit Knowledge and Explicit Knowledge

Dimensions	Tacit Knowledge	Explicit Knowledge
Codification	Low	High
Complexity	High	Low
Context Specificity	High	Low
Consciousness	Practical consciousness	Discursive consciousness

Codifiability

Codifiability refers to the degree to which knowledge can be composed into a set of identifiable patterns and relationships that can be easily communicated (Kogut and Zander, 1992). Explicit knowledge can be highly codified. Explicit knowledge can be separated from knowledge workers who own it and it can be captured in words, formulae, maps and graphs (Polaniy, 1966). Tacit knowledge, on the other hand, has a low codifiability. Tacit knowledge is ambiguous and vague in its forms and its contents (Spender, 1996). The ambiguity of tacit knowledge reduces the likelihood that knowledge workers detect their own or others' tacit knowledge (Galunic and Rodan, 1998). The low probability of detection on tacit knowledge makes it difficult for knowledge workers to codify it.

Complexity

Knowledge can vary in terms of complexity. Complexity refers to the extent to which knowledge is perceived as difficult to understand and use (Rodgers, 1962). Explicit knowledge has a discrete attribute and it can be composed of limited number of elements. Each element is configured under certain structures and sequential orders. The simple composition and sequential order help knowledge workers to understand explicit knowledge. In contrast, tacit knowledge is composed of complicated and differentiated elements (Kogut and Zander, 1992). These components are interrelated without obvious structures and patterns. The unstructured configuration of tacit knowledge increases its complexity.

Context Specificity

Context specificity refers to the extent to which knowledge is highly contextualized and relies on unidentified aspects of the local environment (Nelson and Winter, 1982). Explicit knowledge has low context specificity. Explicit knowledge sustains its meaning and contents across its contexts. The broad context of explicit knowledge implies that it can be generalized to various circumstances and uses. In contrast, tacit knowledge is heavily contingent on its local contexts. Tacit knowledge is developed through repeated experiences and actions in a specific and narrow setting. As a result, the meaning and the use of tacit knowledge is heavily relied on its specific context (Nonaka, 1994) and the values and implications of tacit knowledge vary in different contexts (Ambrosini and Bowman, 2001).

Consciousness

Giddens (1984) proposed in his structuration theory that human beings enact their actions with two main levels of consciousness: discursive and practical. The discursive consciousness provides human beings with rationalizations for their actions and it refers to more conscious and more explicitly knowing (Nonaka and Toyama, 2003). On the other hand, practical consciousness is related to the level of awareness that we do not really think about or theorize (Nonaka and Toyama, 2003). While tacit knowledge is involved with practical consciousness, explicit knowledge is related to discursive consciousness (Nonaka and Toyama, 2003; Spender, 1996). For instance, when knowledge workers use explicit knowledge, they understand what they are doing. In contrast, tacit knowledge is exercised at the implicit level and knowledge workers do not recognize exactly what they are doing with the use of tacit knowledge (Tsoukas, 2003)

Group Learning

The understanding of basic learning processes is necessary to distinguish learning from other exogenously induced group performance changes such as group creativity, group decision making, and group productivity (Wilson et al, 2007). The process of sharing, storage, and retrieval is the basic element of the learning process (Hinz, Tindale, &Vollrath, 1997; Wilson et al, 2007; Walsh and Unsgson, 1991). In this section, I present propositions of how different knowledge types affect each group learning process (sharing, storing, and retrieving). I summarize main propositions of the conceptual model in figure 1.

In particular, this paper focuses on the group learning of knowledge workers as a boundary condition. Drucker (1989) described knowledge workers as individuals who carry knowledge as their main resources. They deal with work that is characterized as intellectual in nature (Alvesson, 2000), non-repetitive, and result-oriented (Vogt, 1995). Knowledge workers have strong motivation and capacity to create new insights and they also facilitate the implementation of new ideas (Vogt, 1995).As knowledge is a critical resource to knowledge workers, their group learning is an ideal setting to consider interactions between knowledge properties and group learning processes.

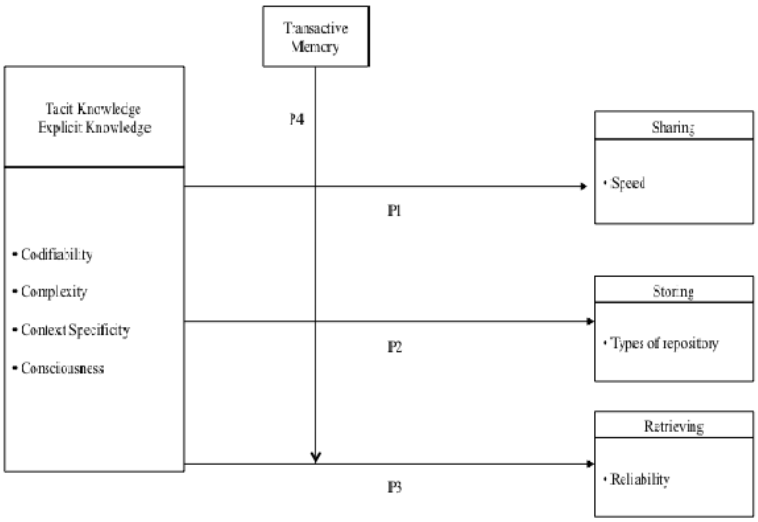

Figure 1: The Overview of Conceptual Framework

Sharing

Wilson and his colleagues (2007) defined sharing as the process by which knowledge becomes distributed among group members and members understand that others in the group possess that knowledge. The efficiency and effectiveness of knowledge sharing depends on how quickly a group build common understanding. We elaborates how the characteristics of tacit and explicit knowledge influence the speed of knowledge sharing among knowledge workers. The low codifiability makes tacit knowledge ambiguous and vague in its forms and contents (Spender, 1996). The ambiguity of tacit knowledge requires extensive repeated and costly personal contact so as to share tacit knowledge to other group members (Brown and Duguid, 2000). In addition, the high complexity of tacit knowledge deters knowledge sharing by increasing the difficulties of understanding and use on it. Especially, it is challenging for knowledge workers to understand tacit knowledge, which is configured with many complex and differentiated elements without evident structures. Furthermore, practical consciousness makes knowledge workers use tacit knowledge unconsciously. Great attentions and efforts are necessary for knowledge workers to understand and express the subconscious mechanisms of tacit knowledge. Difficulties in perceiving tacit knowledge, hence, delay the sharing of knowledge within a group. Moreover, the high context specificity of tacit knowledge makes its meanings and forms vary across contexts. Tacit knowledge is heavily

customized to one particular use due to its narrow context, increasing its specificity and lowering its chances of flowing elsewhere (Galunic and Rodan, 1998).

In contrast, explicit knowledge has specific and declarative meanings and forms due to its high codifiability. The low context specificity makes explicit knowledge generalized to broad contexts. The high codifiability and low context specificity facilitates the sharing of explicit knowledge among knowledge workers. Moreover, discursive consciousness helps knowledge workers easily recognize what they are doing when they use explicit knowledge. The low complexity of explicit knowledge also helps knowledge workers understand its details. Accordingly, discursive consciousness and low complexity enhance the sharing speed of explicit knowledge among knowledge workers. In sum, the characteristics of tacit knowledge, such as low codifiability, high context specificity, the practical consciousness, and high complexity, will slow down knowledge sharing among knowledge workers, compared to explicit knowledge. In general:

> *Proposition 1: As the dimension of tacitness of knowledge increases, the speed of knowledge sharing is diminished among knowledge workers due to its low codifiability, high context specificity, high complexity, and practical consciousness.*

Storing

Storing is defined as as a process by which shared knowledge in the group is retained for the future use (Walsh and Ungson, 1991). The storing process requires certain repositories to store knowledge. Accordingly, repository becomes an essential element of storing processes and the location of stored knowledge affects the storing processes. The characteristics of tacit knowledge make knowledge workers its main repository. It is difficult to capture tacit knowledge in books, documents, and databases due to its low codifiability. Moreover, the high complexity of tacit knowledge prevents knowledge workers from detecting visible patterns and structures for recording. High context specificity of tacit knowledge produces variations in its contents and meanings in terms of local contexts. Furthermore, practical consciousness makes it difficult for knowledge workers to record tacit knowledge, which is used unconsciously. These characteristics of tacit knowledge require a flexible and refined repository in the storing process. Human memory is subtle and adaptive enough to retain ambiguous and versatile tacit knowledge (Wilson et al, 2007). Human memory can extract the common attributes exemplified in diverse observations or experiences and formulate rules for generating behaviors with similar structural characteristics. Bandura (1977) called this process abstract modeling of human memory. Furthermore, Polanyi (1958) proposed that tacit knowledge can be indwelled in a comprehensive cognizance of the human mind and body. Accordingly, groups can store tacit knowledge in group members (Argote and Ingram, 2000; Grant, 1996).

On the other hand, the characteristics of explicit knowledge make knowledge workers rely on formal memory systems in the storing process rather than their own memory. Formal memory systems rely on the development of information technology structures in the current workplaces (Wilson et al, 2007). It includes shared databases, bulletin boards, and electronic hand books (Olivera, 2000). Moreover, formal memory systems include documentary repositories such as documents, books, and manuals. The high codifiability of explicit knowledge makes it possible for formal memory systems to codify it. Formal memory systems can easily capture the content of explicit knowledge, which is stable and consistent across time and contexts due to its low context specificity. The low complexity and discursive consciousness of explicit knowledge facilitate knowledge workers to retain it in formal memory systems (Goodman &Darr, 1998).Accordingly, explicit knowledge is more likely to be stored in formal memory systems. In sum, the characteristics of tacit knowledge such as low codifiability, high context specificity, practical consciousness, and high complexity, make the

memory of knowledge workers a main repository. In contrast, the features of explicit knowledge lead knowledge workers to store it in formal memory systems. In general:

Proposition 2: As the dimension of tacitness of knowledge increases, knowledge workers would be more likely to store knowledge in human memory rather than in formal memory systems due to low codifiability, high context specificity, high complexity, and practical consciousness.

The types of repository affect the amount of stored knowledge and the time required to store knowledge. Human memory has limited capacity to process information (Simon and March, 1958). Furthermore, compared to formal memory systems it takes considerable time to store knowledge in human memory when knowledge is complex and ambiguous. In contrast, formal memory systems can store large amount of knowledge in very short time. The large memory of formal memory systems can increase the details and the amount of knowledge at the same time.

Retrieval

Retrieval implies that group members can find and access the knowledge for use (Wilson et al, 2007). Even though knowledge workers share knowledge with each other and store knowledge within human memory or formal memory systems, they might still fail to use it without the retrieving processes. Storing is a precondition for the retrieving process in nature because the retrieving process is accessing what is already stored. The properties of repository, hence, affect the retrieving processes. The retrieving process of tacit knowledge becomes less reliable due to the features of human memories. First, people forget incrementally what they have known over time. In particular, the rate of forgetting may be fast when the opportunity to practice stored knowledge is infrequent (Donovan &Radosevich, 1999). Second, human beings might distort knowledge when they retrieve it from their memories based on their personal values and past experiences. Hence, what gets retrieved can be different from what was originally stored (Wilson et al, 2007). Third, the change of memberships in a group is directly related to the loss of tacit knowledge stored in knowledge workers. (Levitt and March, 1988). Turnover is a critical issue to retrieve tacit knowledge considering the fact that knowledge worker turnover has been higher than other employee groups (Despres and Hiltrop, 1995).When knowledge workers leave organizations, they take away their tacit knowledge with them.

On the other hand, formal memory systems enable knowledge workers to reliably retrieve explicit knowledge. First, contents stored in formal memory systems are stable and consistent over time. Formal memory systems rarely forget the retained knowledge. Second, formal memory systems minimize differences between what gets retrieved and what was originally stored. Third, the change of memberships in a group does not significantly affect the retrieval of explicit knowledge, which is preserved in formal memory systems. The loss of knowledge workers does not imply the loss of explicit knowledge as long as their explicit knowledge remains the formal memory systems. In sum, the retrieving process of explicit knowledge is more reliable than that of tacit knowledge due to the different properties of human memory and formal memory systems. In general,

Proposition 3: As the dimension of tacitness of knowledge increases, the retrieving process is likely to become less reliable due to the liabilities of human memory.

Dilemma of Knowledge Workers in Tacit Knowledge

Even though knowledge workers use both explicit knowledge and tacit knowledge for their work, tacit knowledge is more critical to knowledge workers and group learning. Tacit knowledge is the foundations of know-how, skills, and practical knowledge of knowledge workers (Grant, 1996). The idiosyncratic and inimitable properties of tacit knowledge

make it the most strategically important resource which firms possess (Nonaka and Takeuchi, 1995; Argote and Ingram, 2000). Tacit knowledge is also essential for competent performance in work situations of knowledge workers (Wagner and Sternberg, 1986). Hence, it is critical to organizations how much tacit knowledge is shared, retained and retrieved among knowledge workers in group learning. However, as I discussed previously knowledge workers are more likely to share, store, and retrieve explicit knowledge through group learning than tacit knowledge due to its low codifiability, high context specificity, high complexity and practical consciousness. As a result, organizations face a serious dilemma in their group learning. Whereas tacit knowledge held by knowledge workers may lie at the heart of their group learning, the characteristics of tacit knowledge prevents that group members share, store, and retrieve their tacit knowledge. I suggest that the development of transactive memory can medicate this critical problem in group learning.

Transactive Memory

Transactive memory refers to a set of memory systems, which integrate knowledge possessed by particular members through a shared awareness of who knows what (Wegner, 1987). The development of transactive memory is highly feasible within a group (Moreland, 1999). Transactive memory does not require knowledge workers to internalize others' knowledge. (Wegner, 1987). Transactive memory systems store knowledge of who is proficient at which tasks and with which skills (Argote and Ingram, 2000).This paper argues that transactive memory is an potential response to the dilemma of knowledge workers in their group learning. In the sharing process, the properties of tacit knowledge slow down knowledge sharing among knowledge workers as noted above. Transactive memory allows knowledge workers simply to know who possesses certain tacit knowledge, rather than to internalize tacit knowledge through the intensive personal interactions. This implies that transactive memory facilitates "knowledge connections" rather than "knowledge transfer" in the sharing process of group learning (Enberg, Lindkvist, and Tell, 2006). When one party learns vicariously from another's experience, knowledge has transferred (Argote, 1999; Singley& Anderson, 1989). Through knowledge transfer the specific knowledge of a group member is shared with other group members. However, transferring knowledge is very costly and time consuming—particularly when the knowledge is tacit (Galunic & Rodan, 1998; Polanyi, 1962; Polanyi, 1967). Buckley and Carter (2004) identified categories of barriers that inhibit transferring knowledge for combination: knowledge boundaries (due to differences in individuals' expertise, norms, and languages) and opportunism (expressed as unwillingness to share knowledge and information). Furthermore, Grant (1996) argued that transferring knowledge is not an efficient approach when production requires the integration of many people's specialized knowledge. Instead, transactive memory enables the sharing process to occur by connecting specialized knowledge across individuals. Transactive memory brings together people who has relevant tacit knowledge for group tasking and group members pool their tacit knowledge through simultaneous or sequential activities without knowledge transfer. Group members learn who has certain skills and expertise through the interaction with others rather than learn the entirety of other's knowledge. In this sense, transactive memory reduces the complexity of tacit knowledge.

In the storing process, transactive memory enables knowledge workers to use formal memory systems when they store tacit knowledge and increases codifiability of tacit knowledge. Transactive memory can be reserved by the form of the list of expertise of group members. This list could be stored in formal memory systems. In this sense, transactive memory can be considered one of the ways to externalize tacit knowledge to explicit knowledge. Externalization refers to processing that tacit knowledge, which embedded in humans' mind or body, can be 'translated' (Nonaka and Takeuchi, 1995:105) into explicit knowledge. The boundary between explicit and tacit knowledge is both porous and flexible, so there is traffic between two domains (Spender, 1996). Polanyi (1966; 1969) argued that a part of tacit knowledge can be known explicitly. By storing assessments of who knows what, transactive memory enables individuals to treat others as the

external stores of tacit knowledge (Wegner, Erber, & Raymond, 1991). In other words, a group only needs to store the list of who knows what rather than the tacit knowledge of group members. Storing the list of who possesses certain tacit knowledge is not as complicated and ambiguous as storing tacit knowledge itself.

Transactive memory makes the retrieving process of tacit knowledge more reliable. Transactive memory reduces the probability of the distortion during the retrieving process because knowledge workers retrieve the list of expertise list rather than the substantive knowledge through their transactive memory. Moreover, transactive memory for tacit knowledge can be stored in the formal memory as noted above. This enables transactive memory for tacit knowledge can be retrieved reliably and consistently maintained over time. Thus, transactive memory can stimulate sharing, storing, retrieving process of tacit knowledge among knowledge workers in group learning. In general:

Proposition 4: The development of transactive memory would positively moderate a relation between the degree of tacit dimension and sharing, storing and retrieving in group learning.

Nevertheless, I do not propose that transactive memory is the panacea of the group learning process of knowledge workers. It is not easy to develop transactive memory of tacit knowledge among knowledge workers. The implicitness of tacit knowledge makes it difficult for knowledge workers to perceive what kinds of tacit knowledge other knowledge workers currently possess. Tacit knowledge is still resided within individuals. The change of memberships in a group significantly affects the sharing storing, and retrieval of tacit knowledge with the use of transactive memory. Furthermore, interactions among knowledge workers are still necessary to give rise to shared understandings of where knowledge resides in groups. Hence, building transactive memory involve prolonged and costly interactions among knowledge workers with where tacit knowledge resides.

DISCUSSIONS

Previous group learning literature has mainly focused on the outcomes or effects of group learning. There is a lack of studies that pay attention to the basic learning processes (Wilson et al, 2007). Furthermore, little attention was given to how group learning processes are related to the properties of knowledge, which are considered raw material in group learning. One of the objectives of this paper was to respond to these gaps in the literature by examining the effects of knowledge properties on group learning processes. In particular, I proposed causal mechanisms to show how properties of knowledge induce disparate group learning processes by introducing mediators in each process: knowledge flow and the types of repository. Each group learning process illustrates how the properties of tacit knowledge prevent knowledge workers from utilizing tacit knowledge. This reveals the dilemma of knowledge workers facing in their group learning. Whereas tacit knowledge is critical to group learning among knowledge workers, the properties of tacit knowledge delays to share, store, and retrieve tacit knowledge. I proposed transactive memory as a intervention that ease the dilemma of knowledge workers: transactive memory. Transactive memory, which is based on learning who knows what, facilitates knowledge workers' ability share, store and retrieve tacit knowledge without internalizing it during group learning. One of the theoretical implications in this paper is to extend the understanding of group learning processes by introducing the constructs of knowledge management theory. Even though group learning research and knowledge management research are closely related to each other in terms of research topics, there are not many communications between them. One of the reasons for the disconnection between knowledge management and group learning literature is the differences of unit of analysis. The level of analysis in group learning is group. In contrast, knowledge management research focuses on organization or inter organization. This paper suggests that the concepts of knowledge management theory, such as

properties of knowledge and transactive memory, can be integrated into the group learning mechanisms and creates new insights on the process of group learning.

In addition, the conceptual framework of group learning presented in this paper has practical implications. First, managers need to understand that tacit knowledge follow different group learning processes from explicit knowledge. The understanding of group leaning mechanisms on tacit knowledge might facilitate mangers to enhance the use of tacit knowledge. Second, this study identifies that the dilemma of knowledge workers on tacit knowledge is a critical issue for companies. This paper suggests that externalization and transactive memory provide firms with possible ways to manage this dilemma. For instance, firms stimulate group learning processes by developing directories or databases of expertise of their knowledge workers. The theoretical framework suggested in this paper has several limitations. First, the conceptual model is limited to group learning of knowledge workers. The dilemma of tacit knowledge might not apply to contexts, which emphasizes explicit knowledge. Nevertheless, this limitation can be justified as the importance of knowledge workers is increasing in most business areas. Second, although this paper dealt with sharing, storage, and retrieval discretely for the sake of clarity, the three processes closely interacted in real worlds (Wilson et al, 2007).The simultaneous interactions among sharing, storing and retrieving provide future research opportunities. Third, even though this paper suggests two possible ways to deal with the dilemma of knowledge workers, there are still other possible interventions to promote group learning processes of tacit knowledge. One promising intervention is the strength of interpersonal relationships among knowledge workers. In particular, as highlighted earlier, social intercourse among knowledge workers is necessary to develop both transactive memory and externalization. A future study might explore the effects of the strength of relationships among knowledge workers on the group learning processes.

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